In-flight medical emergencies: an overview

Tony Goodwin

This article was commissioned to go with the preceding article on in-flight medical emergencies. It provides an indication of the range of medical conditions health professionals may be asked to deal with on board an aircraft

Airport Medical Services, Forte Posthouse Hotel, Horley, Surrey RH6 0BA

Tony Goodwin
senior partner

amsgatwick@compuserve.com

BMJ 2000;321:1338–41

In-flight medical emergencies are attracting increasing interest from the media, travelling public, aviation industry, and medical profession. I discuss the reasons for this and the magnitude of the problem estimated from available data. Methods for preventing these emergencies and the facilities for dealing with them are listed and future requirements are considered.

Summary points

- In-flight emergencies will increase as more elderly passengers fly greater distances
- Data on emergencies and deaths worldwide are scarce, but should improve now that there is an agreement to monitor and report in-flight incidents
- Removal of legal liability concerns should encourage doctors who are on board to come forward

Methods

I searched recent literature for published articles and also drew information from conference presentations.[1–3] Statistics were made available by Virgin Atlantic Airways.

The problems

Older, less healthy, passengers often wish to fly considerable distances, and they expect that the airlines will look after them should problems arise. Similarly, people with known illnesses or disability expect no discrimination and that special facilities should be provided to make their journeys possible.

Air travel can precipitate or contribute to medical problems in a number of ways, even in previously healthy travellers. The stress of getting to and through a modern airport may be considerable. Uncertainty due to delay compounds any anxiety and may mean that too long is spent drinking at the bar. Three quarters of medical emergencies occur while travellers are still on the ground.[4]

Once in the air the drop in pressure (the cabin is kept at the equivalent of 6000-8000 feet (1950-2400 m) altitude) causes 30% gas expansion, and less oxygen is available. Pain from middle ears and sinuses blocked by catarrh is common, especially on the descent. Decongestants, analgesics, and swallowing are all the doctor can offer. The effect on pneumothorax was well publicised when, on a flight from Hong Kong to London, Professor Angus Wallace relieved a tension pneumothorax with the aid of a catheter, coat hanger, and brandy bottle.[5] The reduced partial pressure of oxygen should not affect the healthy passenger, but it may affect those with compromised cardiovascular or respiratory systems or blood disorders.[6] Shortness of breath may be due to myocardial insufficiency or lung disease, or to hyperventilation, which can be helped by breathing into one of the readily available paper bags.

As the journey proceeds the dry cabin atmosphere irritates mucous membranes. Drinking extra fluid helps, but drinking alcohol has the opposite effect. The intoxicating properties of alcohol are enhanced at altitude and often contribute to "air rage," as does the smoking ban in nicotine addicts.[7] Time zone changes and altered meal times can result in insulin dependent diabetics becoming hypoglycaemic, though diabetic meals can be provided. Passengers on other strict drug regimens, such as for epilepsy, may also have problems, especially if they have packed their medication in the hold. Restricted space in most seats encourages musculoskeletal aches and venous stasis.[8] Regular stretching exercises and walks to the toilets when the seat belt sign is extinguished are recommended. Scalds are quite frequent from hot drinks in a crowded area, and head injuries caused by items falling from overhead storage bins are quite common (6.3% of incidents reported by British Airways) (M Bagshaw, British Airways, personal communication). Finally, problems on the individual flight can cause medical emergencies: though rapid decompression of the cabin is thankfully rare, turbulence is much less so. One passenger was killed and 110 injured when a Boeing 747 suddenly dropped 1000 ft on a flight from Japan to Honolulu in December 1997.

Data collection

The size of the problem is not known and the risks involved are hard to estimate. Airlines have not been required to monitor medical incidents or notify a central register. Furthermore, there is no clear definition of an "incident" or "emergency," and this leads to wildly inconsistent data. Does this definition include diarrhoea and vomiting, or a faint? These are the most common conditions in flight for which medical help is sought (M Bagshaw, personal communication).

In an attempt to rationalise data collection, the Airline Medical Directors Association agreed in November 1999 that the Aerospace Medical Association will collect data on in-flight medical incidents. The reporting system will be international and voluntary. The report forms are now available to airlines and a website is being set up to facilitate responses.

Diversion of planes for medical emergencies

Diversions for genuine medical emergencies depend on the routes operated and the location of airports with medical and aviation facilities. The increasing use of super widebodied and super longhaul aircraft is likely to further restrict choice. The commonest reasons for diversion in a recent US study were cardiac incidents (28%), neurological problems (20%), and

food poisoning (20%).[9] Other reports have cited severe and uncontrollable pain or bleeding, major injury with shock, impending birth, and uncontrollable mental disturbance. Virgin Atlantic Airways flights diverted eight times for such cases in 1998 and 10 times in 1999 out of over 28 000 flights in the two years. It is unfortunate that confidentiality prevents airlines from learning the outcome of all these cases, and audit must largely be based on the percentage of hospital admissions. The American study of 1132 in-flight emergencies showed that 173 patients (15%) were admitted to hospital, with an average stay of 2.8 days, and 15 patients (1.3%) died.[9]

Various figures are reported for in-flight deaths, in the range of one death per 1.5-4.7 billion passenger miles flown.[1 10] There is a suspicion, however, that death rates are underreported because of bad publicity and, as on the ground, the patient will sometimes not be declared dead until arrival at hospital.

Scope for prevention

Though most medical emergencies in the air happen unexpectedly it should be possible to avoid many by careful screening of passengers with pre-existing medical conditions. Unfortunately these often come to attention only when a passenger requests some extra facility (a stretcher or medical escort) or makes a medical declaration for holiday insurance. The information is usually provided on the IATA "Medif" form, a two part form that has to be filled in by both client and doctor. It is badly designed, and the information given is sometimes inadequate, which may make it difficult to assess if the patient is fit to fly. Virgin Atlantic Airways referred nearly 2000 such cases to me in 1999, the number having increased by 55% from 1246 in 1997 to 1759 in 1998. The only medical emergency causing diversion of which Virgin Atlantic Airways had any prior knowledge was a patient with epilepsy who failed to take the regular medication.

Sometimes a check-in supervisor suspects that a passenger is unwell and telephones the airline's medical adviser or MedAire for advice. This is always difficult to deal with at a distance, as the passenger is usually loath to abandon a trip on the basis of a telephone decision and few airports have a doctor available at short notice.

No criteria for refusing or accepting to carry a passenger are set in stone, but I provide guidelines for relevant airline staff which I constantly review and revise in the light of experience. Some advice on when it is safe to fly after an uncomplicated heart attack, for example, has variously been given as 10 days[11] and 24 weeks unless supplemental oxygen is available.[12] Trial by treadmill as a basis for the decision used to be suggested.[13] New challenges such as the current concern over suspected "peanut allergy" also command attention. It is Virgin Atlantic's policy to refuse to carry women who are 34 or more weeks pregnant but short haul airlines can accept later stages. New babies are considered fit to fly 48 hours after a normal delivery provided the pregnancy was normal and the mother has a confirmation letter from her medical practitioner.

Staff training

All airlines are required to give their staff some training in first aid. Virgin Atlantic's course lasts five days and is followed by a practical and a multiple choice written examination. It covers all aspects of first aid for conditions which occur in aircraft as well as occupational health, manual handling, altitude physiology, and details of medical equipment carried on board. The medical manual and handouts are supplemented by lectures and practical demonstrations, including work in the simulator. The annual refresher course and cardiopulmonary resuscitation practice lasts a day and is followed by an examination. Flight deck crew undergo a day's initial course and a half day annually, dealing with topics ranging from prevention of food poisoning to deciding to divert.

Medical liability

Despite this training, the announcement "Is there a doctor on board?" is often heard, and apparently one is available on between 8% and 86% of flights worldwide.[14] One was not available when requested on Virgin Atlantic Airways flights only four times in 1997 and eight times in 1998. In the United Kingdom there is no legal duty for a doctor to offer assistance in an emergency, although the General Medical Council considers that such a duty exists. The question of legal liability for medical emergencies on board aircraft is confusing because the law varies from country to country. Several major airlines have now taken out insurance policies indemnifying doctors who come forward to help (and the Medical Defence Union now covers its members worldwide). However, a liability clause in the US Aviation Medical Assistance Act of 1998 should make these precautions unnecessary.[15] This act lays down minimum standards for medical equipment on board; a legal duty for airlines to report in-flight medical emergencies and death; and legal protection for airlines and doctors in good Samaritan situations.

Medlink

A recent innovation used by several airlines is Medlink, a direct communication between the flight crew and MedAire, an organisation where doctors attached to the emergency room of the Good Samaritans Regional Medical Centre in Phoenix, Arizona, have studied the problems of in-flight emergencies and can give instant

expert advice.[16] Up to date lists of airports suitable for diversions and details of their medical facilities are also available. Provided the communication is clear, this facility gives confidence to crew and any on-board doctor, and once MedAire has been contacted the doctor is relieved of liability. MedAire's insurance covers this as well as the cost of any subsequent diversion. The captain makes the decision whether to divert or not, and in case of dispute will follow MedAire's advice over that of any on-board doctor or nurse.

Oxygen

Of all the requests received for extra facilities, oxygen for chronic obstructive pulmonary disease or a heart problem is the commonest. The market for in-flight therapeutic oxygen apparently grows by 10-12% per year worldwide. In Virgin Atlantic's flights, oxygen was provided 425 times in 1998, compared with 374 the previous year. Oxygen driven nebulisers can also be provided if requested by the passenger's doctor in advance, but are not ideal in all cases as the flow of 4 l/min does not give optimum performance (it should be 5-6 l/min) and oxygen risks the retention of carbon dioxide in chronic obstructive pulmonary disease (R Coker, personal communication). Spacers are said to be as effective, so might be a suitable alternative to providing battery driven nebulisers. Meanwhile passengers may use their own battery powered nebulisers on board if they are approved by the aircraft engineers.

Contents of Virgin Atlantic's emergency medical kit, 1998

Upper case lid:
Sharpsafe box
Biohazard bag×1
Adrenaline (epinephrine) 1 in 10 000 1 mg in 10/ml (minijet)×2
Adrenaline (epinephrine) 1 in 10 000 1 mg in 10/ml×5
Adrenaline (epinephrine) 1 in 1000 1 mg in 1/ml×2
Atropine (minijet) 3 mg in 30 ml×1
Atropine 1 mg in 1 ml×2
Gulcagen (glucagon) 1 mg×1
Water for injection 10 ml×1
Sodium chloride 0.9% 10 ml×2
Diazemuls 10 mg in 2 ml×2
Ventolin (salbutamol) nebule 5 mg in 2.5 ml×3
Glytrin spray (glyceryl trinitrate) 0.4 m×1
Narcan (naloxone hydrochloride) 400 µg in 1 ml×5
Frusemide 50 mg in 5 ml×2
Efcortisol (hydrocortisone) 100 mg in 1 ml×2
Ergometrine 500 µg in 1 ml×1
Piriton (chlorpheniramine maleate) 10 mg in 1 ml×1
Lignocaine hydrochloride (lidocaine) 1% 5 ml×5
Maxolon (metoclopramide) 10 mg in 2 ml×2
Nubain (nalbuphine hydrochloride) 10 mg in 1 ml×5
Digoxin tablets 0.25 mg×6
Aspirin tablets 300 mg×6
Cinnarizine 15 mg×6
Hyoscine butylbromide 10 mg×3

Lower base:
Res-q-vac manual suction system×1
Sterile instrument set (needle holder×1, forceps×2, scissors×1)×1
Oropharyngeal airway large×1
Oropharyngeal airway medium×1
Oropharyngeal airway small×1
Resuscitation pocket mask×1
Splash goggles×1
Micropore tape×1
5% glucose intravenous infusion 500 ml×1
Intravenous solution administration set×1
Urine collection bag×1
Xylocaine gel 2%/20 g×1
Foley catheter (size 12)×1

Miscellaneous box
Gauze swabs (7.5 cm×7.5 cm)×2
Sterile gloves×2 (pairs)
Prolene sutures 4/0×1
Vicryl sutures 2/0×1
Scalpel×1
Alcohol prep pads×6
Tourniquet×1
Steristrips 6 mm×75 mm×2
Syringes 10 ml×2
Syringes 5 ml×2
Syringes 2 ml×2
Needles 18 gauge×2
Needles 20 gauge×2
Needles 25 gauge×2
Intravenous cannula 14 gauge×1
A sphygmomanometer and stethoscope are located in the defibrillator bag.

The logistics of carrying many oxygen cylinders has led to interest in new ways of providing oxygen on aircraft and various conservers, concentrators, and generating devices are being developed.

Emergency medical kits

The provision of first aid equipment on board aircraft varies considerably worldwide. Before the Aviation Medical Assistance Act was passed the US Federal Aviation Administration called for little more than a simple kit to be carried by cabin staff. Compared with the United States, the recently harmonised European Joint Aviation Requirements have, in their flight operations chapters, medical and first aid kits that are much more comprehensive in content. The executive director of the Aerospace Medical Association neatly defined the problem: "Unfortunately, there is little information available regarding in-flight medical events and medical kit usage. These data are vital if the airlines are ever going to design a standardised list based upon relevant information rather than the educated guess."[17]

A balance has to be found between possible medical requirements and storage space, training, security, shelf life, and cost effectiveness. It is easy to put in too many items. The Emergency Medical Kit carried by Virgin Atlantic Airways was satisfactory at its introduction in 1993; in 1997, however, 17 of the 27 drugs were rejected as inappropriate and 11 new ones added. Usage is constantly monitored. In 1998 the kit (table 1) was opened 144 times. The most commonly used drugs were intravenous glucose, diazepam, and sodium chloride; intramuscular metoclopramide; and salbutamol given through a nebuliser. An additional source of drugs is from the passengers themselves, who will often respond to a public announcement.

Automatic external defibrillators (AEDs)

Virgin Atlantic Airways was the first airline to carry automatic external defibrillators (May 1990), and the Lifepak 500s (Physio-Control Corporation, Redmond, WA) that it carries are simple to use, with clear audio instructions. They include storage of electrocardiographs for subsequent review. They cost around £2500 each, and an extra £20 000 is spent annually on training the 440 pursers and in-flight supervisors in their use. In 1997 they were applied five times; in 1998 and 1999 just twice each year. Provision of defibrillators on board aircraft was controversial until the old unsuccessful and expensive procedure of cardiopulmonary resuscitation and diversion was challenged.[18] Recent litigation has helped increase their popularity, and now most major long haul carriers have obtained them and are training cabin staff in their use.

On-board telemedicine with a remote diagnostic device, Tempus 2000 (RDT, Farleigh Wallop, Hampshire), should be available on Virgin Atlantic's aircraft within a few months. It will be capable of transmitting a 12 lead electrocardiograph, pulse oximetry, end tidal capnography, pulse, blood pressure, and temperature, together with video and communications link direct to the doctors at MedAire.

Conclusion

In-flight medical emergencies are likely to increase as air travel continues to expand and life expectancy

lengthens. Provisions made by the airlines continue to improve in response to this demand and to changing medical technology and practices, but commercial, financial, and practical considerations have to be taken into account.

The role of the on-board doctor has never been easy, often working in isolation with limited facilities in a hostile environment. Recent changes in attitude by the airlines (particularly with respect to medical indemnity) and the availability of Medlink should make the task easier, safer, and more professionally rewarding for those who come forward to help and act within their normal capabilities.

Competing interests: TG receives an annual retainer from Virgin Atlantic Airways as their medical adviser.

1 *Care in the air*. Public seminar at Royal Aeronautical Society, February 1998.
2 *Medical emergencies in the air—the Virgin experience*. International Congress of Aviation and Space Medicine, Singapore, September 1998.
3 Gordon V. *Legal aspects of medical care in the air*. Presented at Royal Aeronautical Society conference on passenger health in the air, London, 12 April 2000.
4 Cummings RO, Schubach JA. Frequency and types of medical emergencies among commercial air travellers. *JAMA* 1989;261:1295-9.
5 Wallace WA. Managing in flight emergencies. *BMJ* 1995;311:1508.
6 American Medical Association Commission on Emergency Medical Services. Medical aspects of transportation aboard commercial aircraft. *JAMA* 1982;247:1007-11.
7 *Conference on Disruptive Passengers*. Royal Aeronautical Society Human Factors Group, British Airways Conference Centre, 12 October 1999. www.raes-hfg.com/xskyrage.htm (accessed 2 Nov 2000).
8 Johnson R. *Economy class syndrome—a false economy?* Presented at Royal Aeronautical Society conference on passenger health in the air, London, 12 April 2000.
9 Garrett JS. *Experience with 1132 in-flight medical emergencies: what have we learned?* Presented at South Californian Institute, 15 January 1999.
10 Crewdson, J. Code blue: survival in the sky. *Chicago Tribune* 30 June 1996:9.
11 British Heart Foundation. Travelling abroad and heeart disease. *Factfile* January 1996.
12 Cox GR, Petersons J, Bouchel L, Delmas J-J. Safety of commercial air travel following myocardial infarction. *J Aviat Space Environ Med* 1996;67: 976-82.
13 ACC/AHA Task Force. Guidelines for the early management of patients with acute myocardial infarction. *J Am Coll Cardiol* 1990;16:249-92.
14 Hordinski JR, George MH. *Utilisation of emergency kits by air carriers*. Washington, DC: FAA Office of Aviation Medicine, 1991. (Technical report No DOT/FAA/AM-9.)
15 Aviation Medical Assistance Act of 1998. Washington, DC: National Archives and Records Administration, Office of the Federal Register, 1998.
16 Emergency telemedicine centre. www.medaire.com/avtelmed.htm (accessed 2 Nov 2000).
17 Rayman RB. In-flight medical kits. *Aviation Space Environment Med* 1998;69:1007-12.
18 O'Rourke MS, Donaldson E, Geddes JS. An airline cardiac arrest program. *Circulation* 1997;96:2849-53.

(Accepted 22 February 2000)

Lifestyle medicines

David Gilbert, Tom Walley, Bill New

Sildenafil and orlistat, prescribed for erectile dysfunction and obesity respectively, have been labelled as "lifestyle drugs" in the popular imagination. Although this description may trivialise serious medical conditions for which the drugs are indicated, it encapsulates concerns that some indications for these drugs might be regarded as issues of personal choice rather than illness. It is difficult to define what we mean by the term lifestyle drug since the perception of what is illness and what is within the sphere of personal responsibility rather than health care may depend on whether one is a potential patient or a potential "payer." The perception may depend on social and cultural norms too,[1] and it is also a function of how a medicine is used. For instance, most people would agree that the prescription of sildenafil for a healthy man unhappy with his sexual performance is a lifestyle use, but would consider differently the case of a diabetic man with neuropathy.

A working definition for this paper might be that a lifestyle drug is one used for "non-health" problems or for problems that lie at the margins of health and well-being (see table). A wider definition would include drugs that are used for health problems that might be better treated by a change in lifestyle; this definition might include drugs such as lipid lowering agents or proton pump inhibitors.

Summary points

- Lifestyle drugs are drugs used for non-health problems or for conditions that lie at the boundary between a health need and a lifestyle wish
- These drugs threaten the financial sustainability of current health systems
- Traditional approaches to regulating medicines are not effective for lifestyle drugs; coordinated action is needed to manage pharmaceutical policy nationally and locally
- Greater public involvement is essential in establishing priorities
- Lifestyle drugs may promote debate about appropriate directions of technological development

Medicalisation

Where to draw the line between lifestyle purposes and legitimate medical use is debated vigorously. Lifestyle drugs are intended or come to be used for conditions that currently lie at the socially constructed boundary between lifestyle wishes and health needs. A lifestyle wish often becomes a health problem when a biomedical cause (for example, a biochemical or genetic factor) or a treatment is found for the "problem." Lifestyle wishes are then portrayed as amenable to health care—medical intervention that can remove responsibility or control from the individual or society. Healthcare professionals may then "claim"

Office for Public Management, 252b Gray's Inn Road, London WC1X 8JT
David Gilbert *senior fellow*
Department of Pharmacology, University of Liverpool L69 3GF
Tom Walley *professor of clinical pharmacology*
9 Countess Road, London NW5 2NS
Bill New *independent health policy analyst*
Correspondence to: D Gilbert dgilbert@opm.co.uk

BMJ 2000;321:1341–4